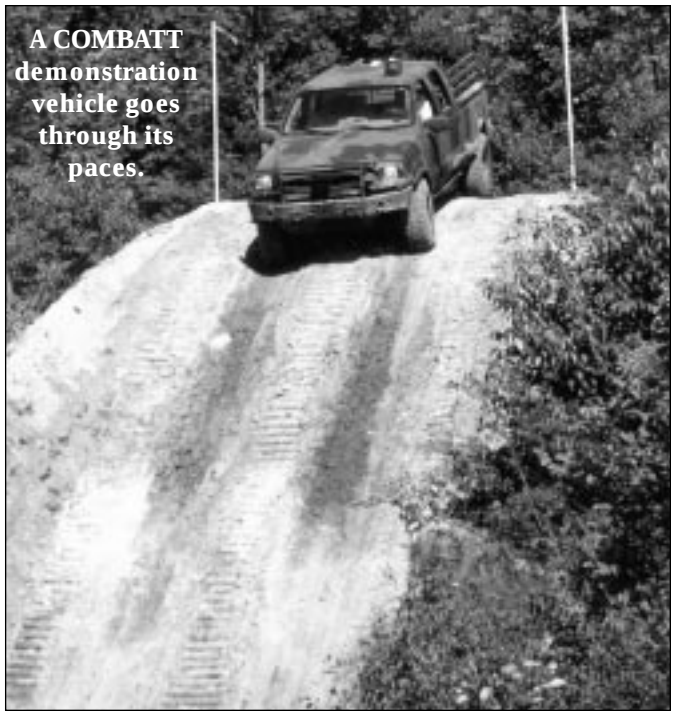

A COMBATT demonstration vehicle goes through its paces.

THE COMMERCIALLY BASED TACTICAL TRUCK

Ronald D. Morton

Introduction

In January 1983, the U.S. Army Tank-automotive and Armaments Command (TACOM) and General Motors Corp. unveiled Commercial Utility Cargo Vehicles (CUCVs) in Flint, MI. This effort began in July 1980 when Congress directed the Army to buy commercial trucks to replace many of the M880 vehicles, Gama Goats, and 1/4-ton trucks operating in areas where high mobility was not essential. As such, the Army accepted 70,889 vehicles between 1983-1987.

Between 1987-1991, the Army learned that neither the M880 nor the CUCV really worked in the Army environment off-road. Neither vehicle had sufficient mobility in mud, sand, snow, or ice, according to Hal Almand, Program Manager for the Commercially Based Tactical Truck (COMBATT) in TACOM's National Automotive Center's (NAC's) Technology Demonstration Group.

Since then, the NAC, Ford Motor Co., DaimlerChrysler, and Veridian ERIM Inc., sought to develop the COMBATT from commercially available trucks such as the Ford F350 and the Dodge 2500/3500. "Our main goal was to modify a commercial truck, make it mobile off-road, where it can go on soft or hard conditions, and make it rugged enough so it would last when working off-road with a payload," said Almand.

COMBATT is a commercial light-tactical vehicle that would be mass produced and upfitted to Army specifications. It provides four overwhelming benefits: reduced production and design costs through economies of scale, lower parts production and distribution costs, the capability of using commercial service manuals, and greatly reduced maintenance costs because of dealership accessibility.

Requirements Determination

A computerized NATO Reference Mobility Model was created by incorporating from the contractors all the design data input on the vehicles. Using this model, engineers determined what kind of mobility the vehicle would yield on any given terrain. NAC personnel examined the model and quickly realized that these unmodified trucks would not go in many of the places that the Army needed them to go.

The NAC then examined performance specifications from the various vehicles, Army requirements, and the High Mobility Multipurpose Wheeled Vehicle (HMMWV) requirements document. Following this, the NAC rated and ranked the various performance characteristics with various vehicle components. Finally, the NAC prioritized the items or components on the vehicle that most needed to be changed.

Tires

Tires were found to be the item that most needed to be changed. Subsequently, engineers increased tire size to 37 inches, the same as the HMMWV tire. However, the COMBATT uses a 17-inch wheel rather than the 16 1/2-inch wheel used on the HMMWV. To maximize the footprint, a central tire inflation system was installed that allows the driver to inflate or deflate the tire as needed. To accommodate the larger tires and wheels, the fender wells were enlarged.

With the footprint appropriate for the vehicle's weight, the engineers realized that a "true" four-wheel drive vehicle was required, one that engages all four wheels simultaneously. Typical four-wheel drive vehicles engage either the left front and right rear tire, or the right front and left rear tire when in the four-wheel drive mode. The Dana Corp. was designated to develop a true four-wheel drive vehicle that met Army requirements.

Ruggedizing The Vehicle

The NAC ruggedized the vehicles for off-road conditions by adding air-helper springs. These cylindrical tubes are filled with air and sit between the axle and the chassis. A central computer within the vehicle's cab controls each spring. The driver can add or subtract air as needed. Thus, a vehicle with a heavy load can be raised and bounce room added to protect the chassis.

To augment the air-helper springs, the NAC added a beefed-up shock absorber. This electrically controlled bistate shock absorber senses energy and automatically switches from firm to soft or vice-versa as dictated by the energy input from the vehicle's environment.

NAC gave COMBATT the same stance as the HMMWV by extending the wheel end and lengthening the axle housing. The steering and front-end geometry are also altered to ensure and maintain a 50-foot turning radius. The entire front axle housing and wheel end are also new. "This was a significant challenge for our engineer staff to make happen and still maintain the feel that you want when you drive," said Almand.

The Computer

Veridian ERIM Inc. built a computer to automatically handle the central tire inflation system, air-helper springs, bistate shock absorbers, and other components. The driver inputs data such as, "I'm off-road or I'm loaded." The computer automatically engages the necessary components. There is even a safety feature, according to Almand. "At 40 mph, you can't have the vehicle suspension all the way up unless you intentionally override the system. The system will automatically set you back down," notes Almand.

For mobility, a Global Positioning System was added, with maps displayed on a flat-panel screen. The screen shows navigation or vehicle system diagnostic information and can be operated by the driver or a passenger.

Night Vision

Night vision technology was also added. The night vision system is mounted on top of the vehicle just above the driver. A camera samples the area directly in front of the vehicle in a 40- by 30-degree field of view. Although the system cannot identify potholes, it has a visual range of 500 feet.

To display night vision images on the panel screen, the system's electronics convert temperature impulses from the sensor array using a digital-to-analog converter. "The final display is not unlike black and white television," said Mitchell Kozera, an electrical engineer with TACOM-NAC.

Collision Warning

COMBATT uses a collision warning system to help eliminate convoy accidents. This system features radar technology with sensors on the vehicle's front and right rear. The front sensor uses an alarm and yellow light to alert the driver that the vehicle is following too closely. If an accident is imminent, a red light and audible alarm are activated. The right rear sensor tells the driver if a vehicle is in a blind spot in the right lane.

Power Generation

COMBATT requires a 110-volt output. The typical Army vehicle output is 28 volts of direct current. In the Dodge vehicle, a system was installed that fits like an alternator and produces up to 5,000 watts. "You could run a house basically on it," said Almand. Inverter technology was used in the Ford, producing a similar output.

Protection

Several safeguards were also added to protect the new components. For example, a brush guard was added to the front of the vehicle, a steel or aluminum plate was attached underneath to protect the oil pan and other components, and a special spray was added to the cab floor and pickup bed. The spray adheres to the base metal, keeping out water and mud. "You can drag anything you want across it and it doesn't scratch into the base metal," said Almand.

To stiffen the chassis, two cross members were tied to the vehicle's bumpers. In addition, a data bus will handle the new electronics, perform diagnostics, accommodate night vision requirements, and process all the signals from the various components.

Conclusion

By leveraging commercial vehicle technology, the Army intends to maintain a consistently modern, mission-ready vehicle fleet while reducing development, production, and spare parts costs. The Commercially Based Tactical Truck should help the Army achieve this goal.

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